The Impact of Climate Change on Regional Air Quality

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The Climate Impact on Regional Air Quality (CIRAQ) project is an ongoing collaborative research effort involving multiple Federal agencies and academic institutions that assesses the impact of future climate change on US regional air quality. In this study, air quality is simulated using the Community Multiscale Air Quality (CMAQ) model under current climatological conditions and under climatological conditions 50 years in the future. A regional climate model (RCM) is driven by a global circulation model (GCM) under one proposed scenario of future greenhouse gas emissions, and a series of regional air quality model simulations is then performed to test the sensitivity of ozone and $PM_{2.5}$ (fine particulate matter) concentrations to changes in regional climate. A preliminary evaluation of the model's ability to represent current climate and air quality is presented and compared with model predictions for the 2050 time period. For the current period, the model adequately simulates means and variability of key climatic variables (surface temperature, pressure, and wind speeds) over the western US, but fails to capture some important synoptic-scale features observed in the eastern US. Although predicted weather patterns remain largely unchanged from their current state under this scenario, modeled average temperatures for the future period are increased by 2–3 K in the Southwest and about 1 K elsewhere. Preliminary air quality modeling results suggest that, for the domain as a whole, the impact of these climatic changes on ozone and $PM_{2.5}$ concentrations is modest, especially when considering nationwide seasonally- or annually-averaged timescales. Future analysis will examine regional and seasonal variations in air quality, which can be expected to be most pronounced in areas such as the Southwest US, where the model results indicate the greatest future warming.

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